State of Utah

Department of
Environmental Quality

Dianne R. Nielson, Ph.D.
Executive Director

DIVISION OF AIR QUALITY
Richard W. Sprott
Director

OLENE S. WALKER
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Lieutenant Governor

DAQE-IN0716039-04

August 27, 2004

David Maxfield
Environmental Manager
US Magnesium LLC
238 North 2200 West
Salt Lake City, Utah 84116

Dear Mr. Maxfield:

Re: Intent to Approve: Modification of Approval Order DAQE# AN0716038-03, For Melt Purification Process, Tooele County - CDS A; ATT; HAPs; NSPS, MACT; Major Title V
Project Code: N0716-039

The attached document is the Intent to Approve (ITA) for the above-referenced project. ITAs are subject to public review. Any comments received shall be considered before an Approval Order is issued.

Future correspondence on this Intent to Approve should include the engineer's name as well as the DAQE number as shown on the upper right-hand corner of this letter. Please direct any technical questions you may have on this project to Mr. Nando Meli. He may be reached at (801) 536-4052.

Sincerely,

Rusty Ruby, Manager
New Source Review Section

RR:NM:re

cc: Tooele County Health Department
Mike Owens, EPA Region VIII

STATE OF UTAH

Department of Environmental Quality

Division of Air Quality

INTENT TO APPROVE: Modification of Approval Order DAQE# AN0716038-03, For Melt Purification Process

Prepared By: Nando Meli, Engineer
(801) 536-4052
Email: nmeli@utah.gov

INTENT TO APPROVE NUMBER

DAQE-IN0716039-04

Date: August 27, 2004

US Magnesium LLC

Source Contact
David Maxfield
(801) 532-1522
Ext. 355

Richard W. Sprott
Executive Secretary
Utah Air Quality Board

Abstract

US Magnesium LLC operates a primary magnesium refinery at their Rowley plant. The Rowley plant is currently operating in the attainment area of Tooele County as a permanent PSD major source. US Magnesium has upgraded their magnesium production plant. This included replacing the electrolytic cells with cells that are more efficient, which resulted in a decrease in the chlorine emissions. In order for the new cells to operate efficiently they had to upgrade other sections in the magnesium production process. This included installing the melt purification process.

The melt purification process consists of a column of ceramic packing which is used to contact molten magnesium chloride with chlorine in order to remove iron residuals. It is necessary to remove the iron from the magnesium chloride (electrolytic cell feed} in order to improve the efficiency of the electrolytic cells. Periodically the ceramic packing is replaced and the column is heated to remove any residual water using a natural gas fired heater before returning the column to operation. The preheater is natural gas fired and is rated at less than 5 million BTU/hr (MMBTU/hr). Natural gas fired equipment that is rated at less than 5 MMBTU/hr is exempt from AO requirements under R307-413-4. US Magnesium has requested that the limitation on preheating the melt purification process be removed. The Rowley plant is a major source and, therefore, is subject to the Operating Permit Requirements. The Title V permit will be administratively amended after the AO has been issued. This AO modification will not result in an increase in emissions.

The Notice of Intent (NOI) for the above-referenced project has been evaluated and has been found to be consistent with the requirements of the Utah Administrative Code Rule 307 (UAC R307). Air pollution producing sources and/or their air control facilities may not be constructed, installed, established, or modified prior to the issuance of an Approval Order (AO) by the Executive Secretary of the Utah Air Quality Board.

A 30-day public comment period will be held in accordance with UAC R307-401-4. A notice of intent to approve will be published in the Tooele Transcript on August 31, 2004. During the public comment period the proposal and the evaluation of its impact on air quality will be available for both you and the public to review and comment. If anyone so requests a public hearing it will be held in accordance with UAC R307-401-4. The hearing will be held as close as practicable to the location of the source. Any comments received during the public comment period and the hearing will be evaluated.

Please review the proposed AO conditions during this period and make any comments you may have. The proposed conditions of the AO may be changed as a result of the comments received. Unless changed, the AO will be based upon the following conditions:

General Conditions:

1. This Approval Order (AO) applies to the following company:

Site Office		Corporate Office Location
US Magnesium LLC		US Magnesium LLC
15 miles North of Exit 77 off I-80		238 North 2200 West
Rowley, Utah		Salt Lake City, Utah 84116
Phone Number:	(801) 532-1522	(801) 536-2043
Fax number:	(801) 596-1132	(801) 536-1407

The equipment listed in this AO shall be operated at the following location:

PLANT LOCATION

15 miles North of Exit 77 off I-80, Tooele County, Rowley, Utah

Universal Transverse Mercator (UTM) Coordinate System: NAD27
4,530.9 kilometers Northing, 354.8 kilometers Easting; Zone 12

2. All definitions, terms, abbreviations, and references used in this AO conform to those used in the Utah Administrative Code (UAC) Rule 307 (R307) and Title 40 of the Code of Federal Regulations (40 CFR). Unless noted otherwise, references cited in these AO conditions refer to those rules.

3. The limits set forth in this AO shall not be exceeded without prior approval in accordance with R307-401.

4. Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved in accordance with R307-401-1.

5. All records referenced in this AO or in applicable NSPS and/or NESHAP and/or MACT standards, which are required to be kept by the owner/operator, shall be made available to the Executive Secretary or Executive Secretary's representative upon request, and the records shall include the two-year period prior to the date of the request. Records shall be kept for the following minimum periods:

A.	Emission inventories	Five years from the due date of each emission statement or until the next inventory is due, whichever is longer.
B.	All other records	Two years

6. US Magnesium LLC (US Magnesium) shall conduct its operations of the magnesium plant in accordance with the terms and conditions of this AO, which was written pursuant to US Magnesium's Notice of Intent submitted to the Division of Air Quality (DAQ) on June 4, 2004.

7. This AO shall replace the AO (DAQE-AN0716038-03) dated May 5, 2003.

8. The approved installations shall consist of the following equipment or equivalent*:

A. Solar Pond Evaporation System

1) multiple diesel engines, and associated pumping and electric generating equipment
2) oil-to-fuel blending system
3) unpaved haul roads
4) diesel storage tanks
5) gasoline storage tanks

B. Chemical Section

1) 05/06 magnesium chloride storage bins
2) baghouse dust collection system for 05/06 magnesium chloride storage bins includes BHA Group, Inc. Top Load Pulse-Jet
3) wet scrubber for the 05/06 storage bins
4) chlorine plant
5) 01, 03, 05 cooling towers
6) diesel engine, surge pump (fire water pump)
7) sand (limestone) feed belt to trough reactor
8) trough reactor mixing cells
9) welding ventilation system
10) chlorine plant bypass scrubber

C. Spray Dryer Section

1) 01, 02, 03 spray dryers each with mist eliminator and packed scrubber
2) three spray dryer stacks
3) three gas turbines

D. Melt/Reactor (M/R) Section

1) chlorine reduction burner (CRB), and associated equipment
2) packed tower absorber for Hydrogen Chloride (HCl) capture
3) 4-E (portable system) and associated equipment launder
4) Emergency Off Gas (EOG) packed scrubber with mist eliminator
5) venturi (high energy) scrubber for particulate capture
6) EOG stack
7) M/R stack
8) two packed towers scrubbers for HCl capture
9) building roof ventilation fans
10) Melt Purification System and auxiliary heater rated less than five million BTU/hr

E. Electrolytics Section

1) 120 M cells and Amax sealed cells with a maximum of 30 Amax sealed cells**
2) ten salt holding cells
3) auxiliary heating system for cells
4) building roof ventilation fans
5) electrolytic cooling tower

F. Casthouse & Magnesium Warehouse Section

1) three casting machines, #01, #02, & #03
2) direct chill casting machine, #04, with cooling tower
3) Sulfur Hexafluoride/carbon dioxide (SF6 / CO2) cover gas
4) casthouse building roof ventilation fans

5) eleven casthouse furnaces, #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, & #11
6) associated natural gas burners and combustion stacks for the casthouse furnaces
7) two covered electric casthouse furnaces, #12, & #13
8) magnesium bandsaw with a dry cyclone for dust collection from the bandsaw

G. Miscellaneous

1) carbon unloading station (baghouse, auger, screen, and conveyor)
2) bulk solids handling system (powder storage)
3) baghouse dust collection system for 02 and 03 magnesium chloride ($MgCl_2$) storage bins
4) research laboratory
5) research laboratory stack
6) sandblasting booth with baghouse dust collection system
7) Air atomizing paint gun, DeVilbiss Model JGA with a rated capacity of 38-48 lb per hour
8) One Safety Kleen Booth for paint gun cleaner

* Equivalency shall be determined by the Executive Secretary.
** There shall be no IG Farben cells in use after October 1, 2001.

General Limitations

9. The following limits shall not be exceeded:

Plantwide chlorine emissions shall not exceed 3,300 tons per rolling 12-month period. Emissions from scheduled maintenance shall not be included in calculating compliance with the plantwide chlorine limit.

A. Chlorine emissions from scheduled maintenance shall not exceed 7,500 tons per rolling 60-month period. Scheduled maintenance shall be defined as maintenance periods where the Executive Secretary has been notified of the planned maintenance at least 30 days in advance of the maintenance.

Chlorine emissions shall be determined by a mass balance equation which shall be approved by the Executive Secretary before being implemented. A copy of the current approved mass balance equation is attached as Appendix A.

US Magnesium shall calculate a new 12-month total by the twentieth day of each month using data from the previous 12 months. The same procedure shall be used for the 60-month rolling total using data from the previous 60 months. However, for the first 60- month period, the beginning of the period shall be the first full calendar month following the AO DAQE-822-00, dated December 20, 2000, and will not "roll" until 60 months following the date of that AO.

Records of chlorine emissions shall be kept for all periods when the plant is in operation and shall be maintained for a minimum of five years. Records of

chlorine emissions, including rolling 12-month totals and rolling 60-month totals, shall be made available to the Executive Secretary or Executive Secretary's representative upon request and the records shall include the five-year period prior to the date of the request.

B. The consumption limits in the auto shop paint booth shall not exceed the following limits:

1) 300 gallons of paint per rolling 12-month period
2) 200 gallons of paint thinner per rolling 12-month period

10. Records of consumption/production/operation shall be kept on a daily basis.

Limitations and Tests Procedures

11. The following general conditions shall apply to compliance testing for all emission points unless other provisions are specified for a particular emission point or air contaminant.

Stack testing to show compliance with the emission limitations stated in this AO shall be performed as specified below:

A. Notification

US Magnesium shall provide a pretest protocol at least 30 days before the test. A pretest conference shall be held if directed by the Executive Secretary. It shall be held at least 30 days before the test between the owner/operator, the tester, and the Executive Secretary, or the Executive Secretary's representative.

B. Sample Location

40 CFR 60, Appendix A, Method 1

For all emission points where compliance testing is required, the emission point shall be designed to conform to the requirements of 40 CFR 60, Appendix A, Method 1, and Occupational Safety and Health Administration (OSHA) or Mine Safety and Health Administration (MSHA) approvable access shall be provided to the test location, and the test site.

C. Volumetric Flow Rate

40 CFR 60, Appendix A, Method 2

D. Particulate

To determine compliance with the particulate mass emission rate limitations for the Spray Dryers, Melt/Reactor (M/R), and Emergency Off-gas (EOG), the concentration of particulates shall be determined by using: 40 CFR 60, Appendix A, Method 5.

The filtration temperature shall be 248 ± 25°F. The sample volume shall be no less than 30 dscf (68°F, 29.92 in Hg) per run, except for the EOG stack, where the sample volume shall be no less than 60 dscf per run. The sample time shall be no less than 60 minutes per run.

E. PM_{10}

For stacks in which no liquid drops are present, the following methods shall be used: 40 CFR 51, Appendix M, Methods 201 or 201a. The back half condensibles shall also be tested using the method specified by the Executive Secretary. All particulate captured shall be considered PM10.

For stacks in which liquid drops are present, methods to eliminate the liquid drops should be explored. If no reasonable method to eliminate the drops exists, then the following methods shall be used: 40 CFR 60, Appendix A, Method 5, 5a, 5d, or 5e as appropriate. The back half condensibles shall also be tested using the method specified by the Executive Secretary. The portion of the front half of the catch considered PM10 shall be based on information in AP-42, Appendix C or other data acceptable to the Executive Secretary.

The back half condensibles (whether liquid drops are present or not) shall not be used for compliance demonstration but shall be used for inventory purposes.

F. Nitrogen Oxides (NO_x)

40 CFR 60, Appendix A, Method 7, 7A, 7B, 7C, 7D or 7E

G. Hydrochloric Acid (HCl)

EPA reference method 26A

H. Chlorine (Cl_2)

EPA reference method 26A

I. Opacity

Opacity observations of emissions from stationary sources shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9.

J. Calculations

To determine mass emission rates (lb/hr, etc.) the pollutant concentration as determined by the appropriate methods above shall be multiplied by the volumetric flow rate and any necessary conversion factors determined by the Executive Secretary to give the results in the specified units of the emission limitation.

Compliance with the 24-hour rolling period shall be based on the data from the previous 24 operating hours data. Compliance with a 30-day rolling period shall be based on the data from the previous 30 calendar days data.

K. Existing Source Operation

For an existing source/emission point, the production rate during all compliance testing shall be no less than 90% of the maximum production rate achieved in the previous six months.

12. Visible emissions from any stationary point or fugitive emission source associated with the source or with the control facilities shall not exceed 20% opacity unless otherwise specified.

13. The opacity of the combined plumes of the Spray Dryers, M/R and E.O.G. stacks shall not exceed 40% opacity. The opacity of each of the above stacks shall not exceed 20% opacity on an individual basis.

14. US Magnesium shall use only natural gas as a fuel in the CRB, melt purification auxiliary heater, spray dryer process burners, and preheaters for electrolytic cells, melt cells and holding cells.

15. US Magnesium shall only use natural gas as a fuel in the spray dryer gas turbine/generators and the duct burners. Fuel oil may be used as an alternate fuel supply during periods of natural gas curtailment, and shut down.

Records & Miscellaneous

16. US Magnesium shall submit a monthly emissions report by the twentieth day of each month to the Executive Secretary. The report shall include:

A. Rolling 12-month total plantwide chlorine emissions.
B. Rolling 60-month total maintenance chlorine emissions.

The parameters used to calculate the Cl_2 emissions shall be submitted with the chlorine emission totals.

17. At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this Approval Order including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Executive Secretary which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded.

18. The owner/operator shall comply with R307-150 Series. Inventories, Testing and Monitoring.

19. The owner/operator shall comply with R307-107. General Requirements: Unavoidable Breakdowns.

Federal Limitations and Requirements

20. In addition to the requirements of this AO, all applicable provisions of 40 CFR 63, National Emission Standards for Hazardous Air Pollutants for Source Categories Subparts A and Subpart TTTTT, 40 CFR 63.9880 to 63.9942 (National Emissions Standards for Hazardous Air Pollutants for Primary Magnesium Refining) apply to this installation.

Solar Pond Evaporation System

21. Visible emissions from any generator or pump engine and associated pumping equipment shall not exceed 20% opacity.

22. The total number of horsepower-hours (HP-hr) produced shall not exceed the following limitation:

    26.59 MMHP-hr per rolling 12-month period.

    Horsepower-hour production shall be determined by monitoring the hours of operation of each engine during the month and multiplying the number of hours of operation by the name plate horsepower rating. All engines shall be equipped with time devices which record the number of hours each engine has operated.

23. The owner/operator shall use only #2 or better diesel fuel, fuel oil or recycled crankcase oil (recycled on site) as a fuel in the diesel engines.

24. The percent of used crankcase oil in the diesel fuel shall not exceed 5% by weight.

25. The sulfur content of any fuel oil or diesel burned shall not exceed 0.5 percent by weight. Sulfur content shall be determined by ASTM Method D2880-71 or D-4294-89, or approved equivalent. The sulfur content shall be tested if directed by the Executive Secretary. The percent by weight of the sulfur contained in the fuel can be obtained from the fuel oil certifications. Certification of fuels shall either be by US Magnesium's own testing or test reports from the fuel marketer. Records of fuel supplier's or US Magnesium's test reports on sulfur content shall be available on-site for each load delivered.

26. All unpaved roads and other unpaved operational areas shall be water sprayed and/or chemically treated with calcium chloride, magnesium chloride or equivalent to minimize fugitive dust as conditions warrant. (R307-205, UAC) Equivalency shall be determined by the Executive Secretary.

Chemical Section

Trough reactor acid neutralization system

27. Emissions to the atmosphere shall not exceed the following limitations:

Source: 05/06 Bin Wet Scrubber

Pollutant	lb/hr	grains/dscf (68^oF, 29.92 in Hg)	Testing Status	Testing Frequency
PM_{10}	2.71	0.016	*	@
HCl	47.5	0.35	*	@

@ Test every five years.

28. The following operating parameters shall be maintained within the indicated ranges for the 05/06 acid scrubber:

A. The recirculated scrubbing liquor shall not exceed a HCl concentration of 5% based on a 24-hour rolling average. The HCl concentration shall be determined by sampling the scrubber liquor once every four hours and titrated in the lab with NaOH. The rate of blowdown will be adjusted to maintain the liquor at or below the 5% concentration. Records shall be kept of all measured concentrations.

B. The liquid to gas ratio shall be no less than 7.37 gpm/1,000 acfm; thus the liquid recirculation rate shall be no less than 140 gpm. Recirculation liquid is the liquid to the packing plus the liquid to the duct sprays.

C. The gas stream from the acid scrubber shall not exceed a temperature of 150^oF.

With the exception of the HCl concentration, the parameters shall be monitored with equipment located such that an inspector can safely read the output at any time. All instruments shall be calibrated at least once every 90 days.

Spray Dryer Section

29. Emissions to the atmosphere from the indicated emission point shall not exceed the following limitations:

Source: Spray Dryers (01, 02 & 03)

Pollutant	lb/hr per spray dryer	test frequency
Particulate	100	@
HCl	200	@

@ Test every five years.

30. Spray Dryer 01, 02 and 03 scrubbers shall meet the following specifications:

Packing height	7 ft
Packing Volume	3,800 cubic ft
Gas velocity in vessel	6.5 ft/sec minimum
Scrubber liquor recirculation rate	2,000 gpm minimum
Mist eliminators	above packing

Melt/Reactor (M/R) Section

Melt/Reactor (M/R) Stack

31. Emissions to the atmosphere from the indicated emission point shall not exceed the following limitations:

Source: M/R Stack

Pollutant	lb/hr	test frequency
PM_{10}	13.1	@
HCl	7.2	@
Cl_2	100.0	@

@ Test every five years.

32. The CRB combustion chamber temperature shall be no less than $1,650^0$F or more than $2,000^o$F for more than five minutes in any 60-minute period. The temperature shall be monitored with equipment located such that an inspector can safely read the output at anytime. The readings shall be accurate to within plus or minus 20^oF. All instruments shall be calibrated at least once every 90 days.

Emergency Off-gas Stack (EOG)

33. The minimum liquid flow rate to the sprays in the EOG scrubber shall be no less than 85 gallons/minute.

The owner/operator shall install, calibrate, maintain and operate a monitoring device for the continuous measurement of the scrubbing liquid flow rate to the EOG scrubber. The monitoring device must be certified by the manufacturer to be accurate within plus or minus 5% of the design scrubber liquid flow rate and must be calibrated on an annual basis in accordance with the manufacturer's instruction. A minimum recording of once per day shall be made of the scrubbing liquid flow rate.

34. Emissions to the atmosphere from the indicated emission point shall not exceed the following limitations:

Source: EOG Stack

Pollutant	lb/hr	test frequency
Particulate	37.5	@
HCl	46.0	@
Cl_2	26.0	@

@ Test every five years.

Chlorine Plant By Pass Scrubber

35. The Chlorine Plant Bypass Scrubber (CPBS) shall control the chlorine emissions from the Chlorine Plant for a minimum of eight hours per 14 day period whenever the Chlorine Plant is not operating. The recovery time for the CPBS to become operational after it has been used to control the chlorine emissions from the Chlorine plant shall not be more than two weeks.

Casthouse and Magnesium Warehouse Section

Casthouse

36. Casthouse Furnaces #1 through #11 shall have the molten magnesium surfaces covered with a molten flux when operating. Furnace covers and inert gas can be used as an alternative to the use of molten flux. Visual inspections shall be made daily by a supervisor to determine compliance with this condition. Records shall be kept daily of the daily visual inspections.

37. Casthouse Furnaces #12 and #13 shall have the molten surfaces covered and purged with sulfur hexafluoride/carbon dioxide or other inert gas when operating. Visual inspections shall be made daily by a supervisor to determine compliance with this condition. Records shall be kept daily of the daily visual inspections.

Paint Booth

38. The paint spray booth shall be equipped with Mid-America 20x25x13/8 particulate arrestors or equivalent to control particulate emissions. All air exiting the booth shall pass through this control system before being vented to the atmosphere (outside building/operation).

39. Visible emissions from the auto shop paint booth or fugitive emission source associated with the source or with the control facilities shall not exceed 10% opacity.

40. The auto shop paint booth emissions of VOCs and Hazardous Air Pollutants (HAPs) from the paint booths shall not exceed:

0.81 tons per rolling 12-month period for VOCs
0.61 tons per rolling 12-month period for all HAPs combined

This value shall not be exceeded without prior approval in accordance with R307-1-3.1, UAC. Compliance with each limitation shall be determined on a rolling 12-month total. Based on the first day of each month a new 12-month total shall be calculated using data from the previous 12 months.

The auto paint shop booth VOC and HAP emissions shall be determined by maintaining a record of VOC and HAP emitting materials used each month. The record shall include the following data for each material used:

A. Name of the VOC and HAPs emitting material, such as: paint, adhesive, solvent, thinner, reducers, chemical compounds, toxics, isocyanates, etc.\

B. Density of each material used (pounds per gallon)

C. Percent by weight of all VOC and HAP in each material used

D. Gallons of each VOC and Hap emitting material used each

E. The amount of VOC and HAP emitted monthly by each material used shall be calculated by the following procedure:

$$\text{VOC} = \frac{\%\ \text{VOC by Weight}}{(100)} \times \left[\text{Density}\ \left(\frac{\text{lb}}{\text{gal}}\right)\right] \times \text{Gal Consumed} \times \frac{1\ \text{ton}}{2000\ \text{lb}}$$

$$\text{HAP} = \frac{\%\ \text{HAP by Weight}}{(100)} \times \left[\text{Density}\ \left(\frac{\text{lb}}{\text{gal}}\right)\right] \times \text{Gal Consumed} \times \frac{1\ \text{ton}}{2000\ \text{lb}}$$

F. The amount of VOC or HAP emitted monthly from all materials used.

G. The amount of VOCs or HAPs reclaimed for the month shall be similarly quantified and subtracted from the quantities calculated above, to provide the monthly total VOC or HAP emissions.

H. Records of consumption of VOCs and HAPs shall be kept for all periods when the auto shop paint booth is in operation.

Miscellaneous

Cleaning Facilities

41. Visible emissions from the Carbon unloading station (baghouse, auger, screen, conveyor and associated pumping equipment shall not exceed 10% opacity.

42. The following emission points associated with the Bulk Solids Handling System (powder storage) shall be enclosed:

A. conveyor belt
B. high speed shaking screen
C. hammermill
D. hoppers

Sandblasting

43. All sand and shotblasting of pieces small enough to fit in the sandblast booth shall be performed inside the sandblast booth with all doors or other openings in the room sealed such that air in the room can only exit through the fabric filter.

44. All abrasive blasting operations shall comply with R307-206, UAC. This rule addresses abrasive blasting operations.

The Executive Secretary shall be notified in writing if the company is sold or changes its name.

This AO in no way releases the owner or operator from any liability for compliance with all other applicable federal, state, and local regulations including R307.

A copy of the rules, regulations and/or attachments addressed in this AO may be obtained by contacting the Division of Air Quality. The Utah Administrative Code R307 rules used by DAQ, the Notice of Intent (NOI) guide, and other air quality documents and forms may also be obtained on the Internet at the following web site:
http://www.airquality.utah.gov/

The annual emission estimations below include point source, fugitive emissions, and fugitive dust, and do not include road dust, tail pipe emissions, and grandfathered emissions. These emissions are for the purpose of determining the applicability of Prevention of Significant Deterioration, nonattainment area, maintenance area, and Title V source requirements of the UAC R307. They are not to be used for determining compliance.

The Potential To Emit (PTE) emissions from the affected processes at the Rowley Plant are currently calculated at the following values:

	Pollutant	Tons/yr
A.	PM_{10}	1,297.37
B.	SO_2	34.74
C.	NO_x	1,518.00
D.	CO	83.56
E.	VOC	200.10
F.	HAPs	
	Cl_2	3,300.00
	Hydrochloric Acid (HCL)	1,060.00
	Ethyl Benzene	0.03
	Toluene	0.12
	Xylene	0.55

The Division of Air Quality is authorized to charge a fee for reimbursement of the actual costs incurred in the issuance of an AO. An invoice will follow upon issuance of the final Approval Order.

Sincerely,

Rusty Ruby, Manager
New Source Review Section

Appendix A

US Magnesium Mass Balance Equation & Procedure

Chlorine Mass Balance

The total chlorine emissions from the Rowley Facility are the sum of emissions from four locations: the cathode stack, the melt reactor stack, the EOG system and from fugitive emissions. This total is determined according to the following mass balance equation and procedure:

Total Emissions = Cathode Stack emissions + Melt Reactor Stack emissions + EOG emissions + Fugitive emissions

Each of the terms of the equation are explained below. In addition, refer to the flow diagram at the end of this appendix.

Cathode Stack Emissions

The Cathode Stack emits the chlorine that is collected from the cathode section of the electrolytic cells. The design of the older electrolytic (IG Farben) type cells allows some of the chlorine that is intended to be collected at the anode for recovery to leak into the cathode section.

In addition to the chlorine from the IG Farben electrolytic cells, the Cathode Stack also receives chlorine from two other non-routine sources:

The Cathode Stack receives the Tail Gas chlorine from the Chlorine Plant when the Chlorine Reduction Burner (CRB) is not operating and,

If the Chlorine Plant is down completely, the Cathode Stack receives all of the flow from the Anode Gas Collection System that normally flows to the Chlorine Plant to be liquefied.

Emissions from the Cathode Stack are determined as follows:

$$B = A - L - T(H/24)$$

and $A = P (2 \times 35.453) / 24.305 = P \times 2.92$
[from $MgCl_2 \rightarrow Mg + Cl_2$]

where
- B = Cathode Stack emissions in tons per day
- A = Anode gas (chlorine) from the electrolytic cells
- L = Chlorine liquified by the chlorine plant
- T = Tail gas from chlorine plant (gas not liquified)
- H = Hours per day the CRB operates
- P = Production of Magnesium in tons per day

Melt Reactor Stack Emissions

The emissions from the Melt Reactor are controlled by the Chlorine Reduction Burner (CRB). The following equation describes the method to be used to determine the chlorine emissions from the CRB.

Emissions from the CRB are determined as follows:

$$Y = X (1 - \text{CRB efficiency})$$

and $X = A - C - E - F - I - T(1 - H/24)$

$$A = T + L - Mr$$

$$L = R + F + I + Mf$$

where
- Y = Emissions from the CRB
- X = Gas flow to the CRB
- A = Anode gas (chlorine) from the electrolytic cells
- C = Chlorine consumed by chemical reactions in the melt reactor
- E = EOG emissions from the melt reactor
- F = Chlorine used for Ferric Chloride production (FeCl3)
- I = Chlorine sales
- T = Tail gas from chlorine plant (gas not liquified)
- H = Hours per day the CRB operates
- L = Chlorine liquified by the chlorine plant
- Mr = Recycled chlorine from the melt purification system
- Mf = Chlorine feed to the melt purification system (Mf Mr)
- R = Chlorine feed to the melt reactor

from above $X = A - C - E - F - I - T(1 - H/24)$

$$A = T + L - Mr$$

$$L = R + F + I + Mf$$

therefore, $X = T + R + F + I + Mf - Mr - C - E - F - I - T(1 - H/24)$

and since $F - F = 0$; $I - I = 0$ and $Mf - Mr = 0$

then $X = T - T(1 - H/24) + R - C - E$

also if the Chlorine Plant is down, then the flow from the melt purification system Mr is sent to CRB. This excess chlorine is called Xc. $Xc = Mr(1 - Hr\_op\_Cl\_Plt/24)$

therefore, $Y = X (1 - \text{CRB efficiency}) = (T - T(1 - H/24) + Xc + R - C - E) \times (1 - \text{CRB Efficiency})$

Additional Notes:

The factor T(1 - H /24) accounts for the practice of routing the tail gas to the Cathode Stack when the CRB is not operating. Compare with the equation for the cathode stack.

R = Chlorine Input

The chlorine entering the Reactor Building is measured and totalized by two flow meters. These meters are used to check each other; a mass flow meter measures the liquid flow to the chlorine vaporizer whereas a magnetic flow meter measures the vapor flow from the vaporizer. The totalizer readout (in pounds of chlorine) for the main flow meters is in the Melt Reactor Control Room. These totalizer readings are the basis for the chlorine input.

After the chlorine passes through the two flow meters, it is measured and totalized again at "individual" flowmeters at the points (up to 10 additional meters on a given day) where it enters the chlorine sparging distribution system. If both of the main flow meters fail, the sum of the individual meters can be used as a chlorine input quantity. The totalizer measurements are manually entered into a spreadsheet. This data is transferred into the plant computer database and archived.

T = Tail Gas

The tail gas mass flow is calculated using the mass of air that enters the chlorine plant with the anode gas and the chlorine concentration, which is based on operators analysis by the potassium/iodate titration method. The mass flow of air entering the plant can be used for the exit flow (tail gas) since the air passes through the plant as an inert whereas the chlorine vapor is liquefied.

C = Chlorine Consumed

The spray dried powder (SDP) fed to the Reactor Building is sampled in the powder storage bins prior to being fed to the Melt Reactor cells. The sample is analyzed for MgO, H2O and iron. The SDP fed to the Melt Reactor cells is weighed and totalized by load cell equipped feeder scales. Load cells also weigh the amount of carbon (coke) fed to the Melt Reactor cells. The hydrogen (chlorine consumer) content of the carbon used is supplied by the vendor and verified by the US Magnesium laboratory. Any iron added (as Fe2O3) to the Melt Reactor cells is added by bagged increments and recorded. The Reactor Control Board Technician is responsible to record all data and analysis during periods of Reactor Building operation.

The purified molten magnesium chloride produced in the Melt Reactor cells, commonly referred to as RBP (reactor building product), is transported to the electrolytic cells via Glama Haulers (with integral load cell) and vacuum wagons that are weighed on a platform scale. The weights are tabulated and totaled daily. During periods of Melt Reactor cell operation the RBP is sampled and analyzed every 1-« hours for MgO, Carbon and Fe. The analysis is used in the calculation of chlorine consumptions. The weight of RBP is used in the material balance calculations to corroborate the Chlorine balance.

1. The Chlorine Consumption is calculated as follows:
    a) (lbs SDP) X (% MgO in SDP - %MgO in RBP)/100 = lbs "MgO" converted
    b) (lbs SDP) X (%H2O/100) = lbs H2 O converted

c) ((lbs uncalcined coke) X (1%/100)) + ((lbs charcoal) X (5%/100)) = lbs hydrogen (H2) converted
d) ((lbs SDP) X (0.55% SO4)/100) = lbs SO4 converted
e) ((lbs SDP) X (%Fe in - %Fe out)/100) = lbs Fe converted

2. Calculations of Chlorine consumption by component:
a) lbs "MgO" X 3.42 = lbs Cl2 consumed
b) lbs H2 O X 3.92 = lbs Cl2 consumed
c) lbs H2 X 0.354 = lbs Cl2 consumed
d) lbs SO4 X 0.737 = lbs Cl2 consumed
e) lbs Fe X 0.64 = lbs Cl2 consumed
f) lbs Fe2 O3 X 0.11 = lbs Cl2 consumed

Total = Total Cl2 consumed in lbs

E = Emergency Off Gas (EOG).

The amount of chlorine emitted by the EOG system is estimated based on the latest stack test data.

Stack test date	results lb/hr
1/12/99	17.21
9/1/93	25.9
10/28/92	45.76

The average, based on the last three stack tests, is 29.62 lb/hr

CRB Efficiency

The Chlorine Reduction Burner (CRB) destruction efficiency is calculated based on the results from the most recent stack testing. Based on past stack testing results, the typical chlorine destruction efficiency of the CRB is 98 to 99%.

Emergency Off Gas (EOG)

The Emergency Off Gas System is used to capture fugitive emissions of chlorine in the Melt Reactor Building. This controls the occupational exposure of the operators to the chlorine fumes. Per the discussion above, the average chlorine emissions from the last three stack tests is 29.62 lb/hr.

Fugitive Emissions

Fugitive Emissions are the non-point source emissions that are not captured by the EOG system. The fugitive emissions for the facility are estimated at 75.0 tons per year. This is based on the odor threshold of chlorine (0.3-0.5 ppm) and the ventilation flows for the four electrolytic cell buildings and melt reactor buildings. Equipment leaks outside of these buildings are also included in this estimate. This estimate of fugitive emissions is based on engineering judgement using the best available information and as described below:

Example Calculation:

Assume there are 165 operating roof fans in the Electrolytic Buildings and the Melt Reactor Building.
Each roof fan is rated at 20,000 cfm.
The density of chlorine at ambient conditions is 0.1587 lb per ft
Concentration of chlorine in the air exiting from the roof fans is 0.5 ppm

Fugitive emissions = 165 x (20,000 ft /min) x (0.1587 lb/ft) x (60 min/hr) x (8,760 hr/yr) x (0.5 x E-06 Chlorine)

= (137,631 lb/yr)(1 yr/12 months)(1 ton/2000 lbs) = 5.73 tons/month

CONCLUSION

Based on the above equations, the following is the mass balance equation:

Total Plant wide Cl2 emissions = Cathode Stk + M/R stk + E.O.G. + Fugitives

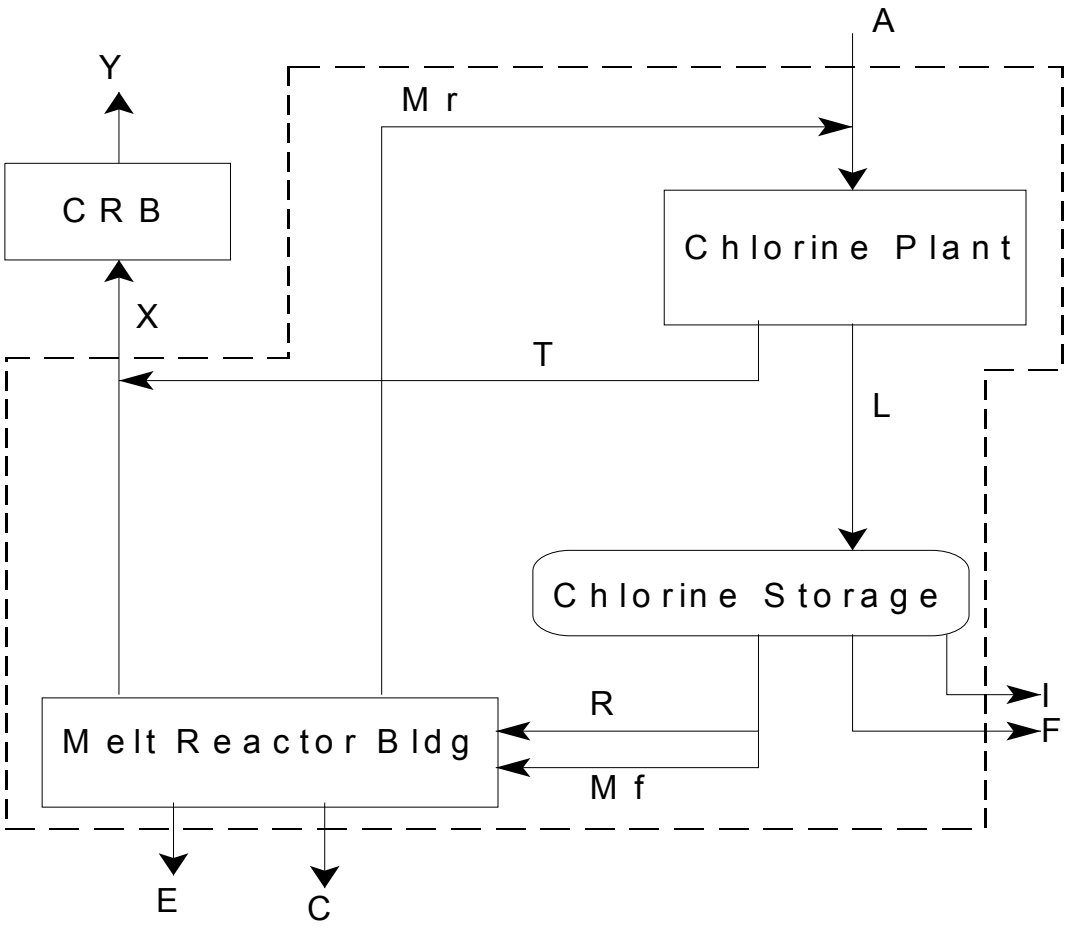
from above discussion, Total Cl2 = B + Y + EOG + Fugitives

with B = A - L - T(H /24)

Y = (T - T(1 - H /24) + R + Xc C E) (1 - 0.98)

EOG = 29.62 lb/hr

Fug = 5.73 ton/month



A - Anode Gas from Electrolytic Cells
L - Liquid Chlorine
I - Inventory Change and Sales
F - Chlorine to FeCl3
R - Chlorine to Melt Reactor
Mf - Chlorine to Melt Purification System
Mr - Recycled Chlorine from MPS
C - Chlorine consumed
E - Fugitives to EOG
T - Tail Gas
X - Flow to CRB
Y - Emissions from CRB